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Page 1

Ferroelectricity News

A quarterly update on what's happening in the field of ferroelectric

Volume 7, Number 2

WORLDWIDE FERROELECTRICITY RESEARCH: INTERDISCIPLINARY IN NATURE

Leafing through conference announcements, meeting reports, or symposium proceedings, one cannot help but be struck by the interlacing and overlapping quality of research in the field of ferroelectricity.

One case in point is the article by **Orlando Auciello, James F. Scott,** and **Ramamoorthy Ramesh** called "The Physics of Ferroelectric Memories" published in the July 1998 issue of **Physics Today**. To find out more about it, turn to page 16.

On pages 15 and 16 you will find information on the **latest publications of the Material Research Society (MRS)**, featuring low-dielectric constant materials and topics such as stresses and mechanical properties of thin films. In addition, you might be interested in a free copy of the 1999 MRS Publications Catalog Supplement (see order information on page 16).

From the National Physical Laboratory in Teddington, Middlesex, UK, comes an invitation to measurement laboratories to cooperate in evaluating methods for determining performance related properties of electroceramics.

Researchers interested in getting involved in the so-called **"Versailles Project,"** will find details on page 14.

IN THIS

From the

Papers

ISIF'99

Update o

Versaille

Publicati

MRS

On fer

Upcomin

15th R

Physic

Piezote

MRS 1

Calendar

Ferroe

In the section Upcoming Meetings we feature the MRS 1999 Fall Meeting in Boston and two conferences that takes place in Russia: the **15th Russian Conference on Physics and Ferroelectrics** and **Piezotechnology 99**, both held at the same time and place from 14 - 18 September 1999 in Azov near Rostov-on-Don.

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As has become the custom in the *Ferroelectricity Newsletter*, the major part of each issue is taken up with listing the titles and authors of presentations at a variety of conferences. This issue is no exception. You will find the oral and poster papers given at the **11th International Symposium on Integrated Ferroelectrics**, held from 7 - 10 March 1999 in Colorado Springs, Colorado, USA. In the next issue we plan to bring you the list of presentations delivered at the **Sixth Japanese - CIS/Baltic Symposium on Ferroelectricity** that took place in Noda, Japan, from 22 - 25 March 1998. These proceedings were published in Volume 218, Numbers 1-4 (1998) of *Ferro-electrics*.

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Rudolf Panholzer
Editor-in-Chief

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Page 2

Spring 1999

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ISIF'99 PAPERS

The following is a list of the titles and authors of the presentations given at the 11th International Symposium on Integrated Ferroelectrics (ISIF'99) held from 7-10 March 1999 in Colorado Springs, Colorado, USA.

PLENARY SESSION I

Suzuki

2C FRAM Mem

Development Challenges of
Gigabit Scale 1T-1C DRAMs

B. Melnick

Retention Performance of SBTN
FRAM Memory

T. Davenport, and S. Mitra

S. Mitra

Piezoelectric and Pyroelectric Thin
Films for Sensors and Actuators

N. Setter

Integration of Ferroelectric Random
Access Memories with a New Cell
Structure Using a Novel Processing
Technology

DEVICE INT ISSUES

The Challenges
Capacitors in E

A.R. Sitaram

PLENARY SESSION II

High-Density FeRAMs

C. Paz de Araujo

Technology Perspective for 1T/1C
FRAMs

K. Kim

PLENARY SESSION III

Studies of Ferroelectric Thin Film
and Film-Based Device Processes
Via *in situ* Analytical Techniques

O. Auciello

CIRCUITS AND DEVICES

Integration Technology for Ferro-
electric Memory

H. Hada and T. Kunio

A 3v 1T/1C 256Kbit FeRAM
Using SBT

*D.A. Kamp, M.V. Cordoba, D.E.
Hodges, G.F. Derbenwick, H.W.
Kye, W.S. Kang, and N.S. Kang*

A 42.5mm² Nonvolatile Ferroelec-
tric Memory Utilizing Advanced
Architecture for Enhanced Reli-
ability

*W. Kraus, L. Lehman, D.
Wilson, T. Yamazaki, C. Ohno,
E. Nagai, H. Yamazaki, and H.*

*D.C. Kim, H.J. Nam, H.M. Lee,
S.M. Cho, W. Jo, J.U. Bu, H.B.
Kang, and K.Y. Oh*

Advanced LSI Embedded with
FeRAM for Contactless IC Cards
and Its Manufacturing Technology

*Y. Shimada, K. Arita, E. Fujii, T.
Nasu, Y. Nagano, A. Noma, Y.
Izutusu, K. Nakao, K. Tanaka, T.
Yamada, Y. Uemoto, K. Asari, G.
Nakane, A. Inoue, T. Sumi, S.
Chaya, T. Nakakuma, H. Hirano,
Y. Judai, Y. Sasi, and T. Otsuki*

An RFID Tag with an Embedded
1K FeRAM Using SBT

*G.B. Coombe, T.A. Meester, M.V.
Cordoba, D.A. Kamp, G.F.
Derbenwick, G. Nakane, A.
Inoue, T. Sumi, and T. Otsuki*

Evolution of the Integration of
FRAM in RFID Applications

D. White, and S. Mitra

A Demonstration of Low Voltage
Performance, From Scaled PLZT
Films, on a Fully Integrated 64K
FRAM

*B. Estep, J. MacWilliams-
Brooks, and S. Mitra*

A Method of Characterizing Sense
Amplifier Imbalance Issues on a 2T/

Integration of P
tric Capacitors
Process for Em

*D.J. Woude
Haspeslagh
Maes*

Remanence Pol
Hydrogen Dam
Thin Film Capa

*S. Traynor,
Hadnagy*

Effects of Ferro
on CMOS in Fe

*S.W. Lee, E
J. Lee, and*

Fabrication of S
Pb(Zr,Ti)O₃
Stopping Layer

*H.M. Lee, D
S.M. Cho, W*

Direct Wafer B
Transfer - A Ne
Integration of F
into Silicon Tec

*M. Alexe, S
D. Hesse, a*

Influence of Dr
and Cl on Struc
Properties of C
Crystalline SrB

W. Hartner, V. Weinrich, G. Schindler, N. Nagel, C. Dehm, C. Mazur, H. Schroeder, and R. Waser

Plasma Etching of Ir/PZT FeRAM

Device Structures

F.G. Celii, T.S. Moise, S.R. Summerfelt, L. Archer, R.A. Beavers, D. Vestyk, S. Johnston, S. Bilodeau, M. Russell, and P.c. van Buskirk

Etching Pt Electrodes in a Decoupled **Plasma** Source Chamber

J. Hwang, S. Mak, C. Ying, K-L. Chiang, and J. Jin

Etching Mechanisms During Platinum Thin Film Patterning with a Microwave Ion Gun

K. Baborowski, P. Muralt, and N. Lederman

FIELD EFFECT DEVICES / THEORY

Advanced Ferroelectric Memory FET Devices

T. Nakamura, Y. Fujimori, and H. Takasu

Fabrication and Characterization of MFSFET Arrays Using Al/BaMgF₄/Si(111) Structures

K. Aizawa, and H. Ishiwara

Ferroelectric-Gate Transistor as a Capacitor-less DRAM Cell

J-P. Han, and T.P. Ma

Characterization of Y1-Based Ferroelectric Gate MOS Capacitors Formed by MOD Technique for

Paz de Araujo

Fabrication and Characterization of MFISFET Using CMOS Process for Single Transistor Memory Application

I. Chung, C.J. Kim, T-Y. Kim, Y. Park, and C.W. Chung

Crystalline Oxides on Silicon - Alternative Dielectrics for a Ferro-Gated Transistor Technology

R.A. McKee, F.J. Walker, and M.F. Chisholm

Epitaxial BaTiO₃ Films on Silicon for MFSFET Applications

J. Hallmark, J. Yu, R. Droopad, J. Ramdani, J. Curless, C. Overgaard, J. Finder, D. Marshall, J. Wang, and B. Ooms

Ferroelectric Self-Field Effect: Implications for Size Effect and Memory Device

Y. Watanabe

FUNCTIONALLY GRADED FERROELECTRICS

Graded Ferroelectrics: A New Class of Steady-State Thermal/Electrical/Mechanical Energy Interchange Devices

N. Schubring, J. Mantese, A. Micheli, A. Catalan, M. Mohammed, R. Naik, and G. Auner

Graded Ferroelectric Thin Films Grown by Molecular Beam Epitaxy

X. Pan, W. Tian, and J. Jiang, J. Hacni, C. Theis, J. Lettieri, and D. Schlom

Ba_xSr_{1-x} tric Device

G. Aun Jin, J. Miche

Functiona (Ba_{1-x}Sr Capacitor Temperatu R. Slo Liedtk

Graded PZ with Stoic MOD Tec Z. Che Paz de

Theory of tures A. L. R Maryl

HIGH FR VICES

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F.A. M C.H. M and G

Dielectric Films for T Devices

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Spring 1999

Ferr

ISIF'99 PAPERS

T.V. Rivkin, C.M. Carlson, P.A. Parilla, and D.S. Ginley

The Role of Strain and Interfaces in Ferroelectrics for Tunable Microwave Devices

H-M. Christen, L.A. Knauss, K.S. Harshavardhan, and S.D. Silliman

Dielectric Properties of (Ba,Sr)TiO₃ Thin Films for tunable Microwave Applications

W. Chang, J.S. Horwitz, W-J. Kim, J.M. Pond, S.W. Kirchoefer, S.B. Qadri, and D.B. Chrisey

Evidence of a Ferroelectric Phase Transition in Fiber-Textured (Ba_xSr_{1-x})Ti_{1-y}O_{3+z} Thin Films on Pt/SiO₂/Si

S.K. Streiffer, S.E. Lash, C.B. Parker, A.I. Kingon, C.E. Bouldin, B. Ravel, D.L. Kaiser, A. Sirenko, and X.X. Xi

Microwave Phase Shifters Based on Ferroelectric Films

A.B. Kozyrev, A.V. Ivanov, T.B.

Effect of the Catalytic Nature of the Platinum Group Metals on Electrode and Barrier Structures for

(Ba,Sr)TiO₃ Thin Film Capacitors

M. Raymond, B White, S. Madhukar, M. Kottke, T. Remmel, B. Melnick, and C. Tracy

The Temperature Dependence of the Dielectric Properties of

(Ba,Sr)TiO₃ Thin Films

T. M. Shaw, J. D. Baniecki, R. B. Laibowitz, D. E. Kotecki, H. Shen, and J. Lian

Leakage Current and Resistance Degradation Behavior of Doped

Ba_{0.7}Sr_{0.3}TiO₃ Thin Films for DRAM Applications

S. Hoffman, M. Grossman, and R. Waser

Effect of N₂O on RF-Magnetron Sputtered SrTiO₃ Films for ULSI DRAM Application

J. Han, V. Balu, J. Lee, R. Mohammedali, S. Gopalan, C. Wong, and J. C. Lee

C. Cabral, Wise

A TiSiN-based Diffusion Barrier Capacitors

H. Horii, B. C.Y. Yoo, H. H.B. Park, Lee

Microstructure Properties of Sputtered Thin Films by M

P. Mahji, Y. S.K. Dey, J. and L. Luo

Use of Deuterium to Investigate Hydrogen Degradation of Capacitors

S.R. Gilber Moise, P. C. Summerfelt

Sputter Deposited Films for Capacitors

L.A. Wills, a

*Samoilova, O.I. Soldatenkov,
L.C. Sengupta, L. Chiu, X.
Zhang, Y. Zhu, S. Stowell, S.T.V.
Rivkin, C.M. Carlson, P.A.
Parrila, and D.S. Ginley*

Low Temperature MOCVD BST
for High Density DRAM Capacitors
*J. Joo, J. Park, Y. Kim, K. Lee,
J. Lee, J. Roh, J. Kim -*

Thermal Stabili
Si/TaN/Ir Elect
Memory Device
*F. Zhang, J
and S.t. Hsu*

MATERIALS AND PRO- CESSES FOR DRAMS

Depletion Widths in BST DRAMs
I: Voltage Dependence
S. K. Dey

Depletion Widths in BST DRAMs
II: Zero-Voltage Value ($d = 5 \pm 2$
nm)
J. F. Scott

MATERIALS AND PRO- CESSES FOR DRAMS: II

BSTO Thin Film for a DRAM
Capacitor: Materials Requirements
and Issues

*J. Lian, H. Shene, M. Gutsche,
G. Kunkel, Y.J. Park, Y. Wang,
C. Lin, D.E. Kotecki, R.
Laibowitz, J.D. Baniecki, K.L.
Saenger, T.M. Shaw, S. Athaval,*

Effects of the M
Platinum Electr
Behavior of TiN
Layer
*D-S. Lee, H
J. Ha, and*

4

Page 5

Ferroelectricity Newsletter

MATERIALS AND PRO- CESSES FOR NVFERAMS

Preparation and Evaluation of
SrBi₂Ta₂O₉ Thin Films Prepared by
the Sol-Gel Method
I. Koiwa

Sub-100 nm SBT Thin Films for
Low Voltage and High Density
FeRAM Applications
*V. Joshi, S. Narayan, L.D.
McMillan, and C. Paz de Araujo*

Effects of Ca and Sr Dopants in
PLZT Thin Films for Low Voltage
Operation

ISIF'99 PAPERS

*H.X. Qin, X.B. Chen, and Y.N.
Wang*

Film Capa
Electrode
*H. Ka
Yamak*

MATERIALS AND PROCESSES FOR NVFERAMS - II

Barrier Layers for Integration of
Ferroelectric Capacitors on Si
S. Aggarwal

Fabricatio
tric Films
*D.A. N
R. Lai
L. Ber*

Texture Control of Pb(Zr,Ti)O₃ Thin
Films
*K. Torii, Y. Matsui, and Y.
Fujisaki.*

Low Temp
Pb(Zr,Ti)O
*T. Fuj
H. Tak*

*S.-H. Kim, D.-J. Kim, J.-P. Maria,
A.I. Kingon, T.D. Hadnagy, and
S. Sun*

Ferroelectric Properties of
Pb_{0.6}Sr_{0.4}TiO₃ Thin Films on
Perovskite Buffer Layers

*C.-S. Hou, G.-C. Chang, C.-C.
Chou, and H.-F. Cheng*

Nearby-Electrode Injection in
Ferroelectric Thin Film Capacitors:
Manifestation in Size Effect and
Fatigue

*A.K. Tagantsev, and I.A.
Stolichnov*

Dielectric and Electric Properties of
Sol-Gel Derived PZT and PNZT
Thin Films

K. Hong, Y.S. Yu, and B.H. Kim

Low Temperature Synthesis of
Ferroelectric Sr₂Nb₂O₇ Thin Films
by Rapid Thermal Annealing

*M. Shoyama, A. Tsuzuki, K.
Kato, and N. Murayama*

Thickness Effect in PZT and SBT
Ferroelectric Thin Film

J.S. Zhu, X.M. Lu, Z.G. Zhang,

Hydrogen-Induced Imprint Mecha-
nism of Pt/PZT/Pt Capacitor by
Low-Temperature Hydrogen
Treatment

*H. Kanaya, T. Iwamoto, Y.
Takahagi, I. Kunishima, and S.
Tanaka*

Analysis of Degradation of Pt/
SrBi₂(Ta/Nb)₂O₉/Pt Capacitors
During Annealing in Reductive
Atmosphere

*A. Tofuku, T. Yoshie, T. Osaka, I.
Koiwa, H. Kato, Y. Sawada, and
A. Hashimoto*

Effect of Top Electrode Deposition
Conditions on the Reliability of Pt/
PZT/Pt Ferroelectric Capacitors

*D.J. Wouters, A.T. Bartic, G.
Norda, and H.E. Maes*

Evaluation of PZT Capacitors with
Pt/SRO and Pt/IrO_x Electrodes for
FeRAM

*J.S. Cross, M. Fujiki, M.
Tsukada, T. Tamura, K.
Matsuura, H. Ashida, and S.
Otani.*

Electrical Properties of PZT Thin

MATERI - CHEMI DEPOSI

Process E
Based Thi
Ceramic C
M. Wa

The Evolu
Chemical
L.D. M

A Study o
Crystalliza
Films Prep
Using Stea
*Y. Saw
Hashi
Kobay*

Thickness
Solution D
on Fatigue
*S.-H. K
and A*

Review of
Processing
C. Deh

Page 6

Spring 1999

Ferr

ISIF'99 PAPERS

and G. Schindler

Comparison of CSD and Sputtered

*P.C. Van Buskirk, S. Bilodeau, S.
Johnston, M. Russel, and D.
Vestyk*

*D.G. Schlo
Lettieri, Y. J
M.E. Hawle*

PZT with **Iridium** Electrodes

*G.R. Fox, S. Sun, B. Eastep, and
T.D. Hadnagy*

Processing of Multilayer PZT

Coatings for Device Purposes

*T. Olding, B. Leclerc, and M.
Sayer*

Chemical Solution Deposition of

BaTiO₃ Thin Films

D-Q. Li, and Q.X. Jia

What is the Outlook for PZT Films for Low Voltage NVM Operation?

*A.I. Kingon, S-H. Kim, D.J.
Kim, J.G. Hong, J-P. Maria,
and S.K. Streiffer*

MATERIALS PROCESSING

- CVD

Chemical Vapor Deposition of SrBi₂Ta₂O₉ Thin Films for Non- volatile Memory Applications

K. Hironaka and C. Isobe

Fatigue Free Ferroelectric

Pb_{0.9}Ge_{0.1}O₁₁ Thin Films Prepared by Metalorganic Chemical Vapor Deposition

T. Li, F. Zhang and S.T. Hsu

Novel Precursors for the MOCVD of Ferroelectric Thin Films

*T.J. Leedham, A.C. Jones, H.O.
Davies, P. O'Brien, P.J. Wright,
M.J. Crosbie, and D.J. Williams*

Low-Voltage Ir/PZT/Ir Integrated Capacitors Formed Using Thin- Film MOCVD PZT

*T.S. Moise, S.R. Summerfelt,
F.G. Celii, L. Archer, P. Chen,
S. Gilbert, M. Anthony,*

Rotating Disk Reactor - Low Pressure Chemical Vapor Deposi- tion (CVD) System Designed for Complex Oxide Film Production

*G.S. Tompa, L.G. Provost, C.
Zhang, J. Mantesse, F.P.
Gnadinger, G. Huebner, and D.
Bingham*

New Low Temperature Preparation of Ferroelectric Bi₄Ti₃O₁₂ Thin Films by MOCVD Method

T. Kuma

Metal-Organic Chemical Vapor Deposition and Characterization of Strontium Bismuth Tantalate (SBT) Using a Novel Liquid Delivery System

*S. Narayan, L. McMillan, C.A.
Paz de Araujo, K. Uchiyama, M.
Schumacker, and H. Juergensen*

Direct Deposition of SrBi₂Ta₂O₉, Film on IrO₂ Electrode Using Liquid Source CVD Method

*T. Eshita, H. Yamawaki, S.
Miyagaki, and Y. Arimoto*

Effects of Growth Conditions and Rf **Plasma** on Crystalline and Electrical Properties of SrBi₂Ta₂O₉, Thin Films Grown by Liquid Delivery MOCVD Using a Double Alcoholate

*T. Jimbo, H. Sano, H. Ishiwara,
Y. Takahashi, E. Tokumitsu, and
H. Funakubo*

MATERIALS PROCESSING - PVD

Epitaxial Growth of Aurivillius Phases by MBE and PLD

*Pan, H. Li,
Auciello, J.
Uecker, and*

Effect of Chara Buffer Layer on Properties of (P Thin Films

*H-F. Cheng
Lin*

Process Stabilit PLZT Thin Film FRAM Product

*K. Suu, N. T
Hickert, D.
Davenport*

Epitaxial Bismu Perovskite Ferr Grown by Pulse

*A. Pignolet
M. Alexe, N
Harnagea,
and U. Gös*

Growth of (111 RUO₂(100) / Electrodes by

*T. Maeder,
Sagalawicz*

SBTN Thin Fil pared by Rf-Ma

*S. Sun, G.R
Hadnagy*

Interfacial Struc tric Properties o Heterostructure (001)SrTiO₃

*K. Wasa, Y.
I. Kanno, K
Schlom, S.
Gan, and C*

Ferroelectricity Newsletter

The Ferroelectric Properties of
PZT40/60 Thin Films Prepared
Using ULVAC ZX-1000 Rf Sputter-
ing System

*F. Chu, G. Hickert, T.D.
Hadnagy, and K-K. Suu*

NOVEL CHARACTERIZA- TION: I

SLIMM: A Technique for Determination of the Spatial Distribution of the Spontaneous Polarization in Ferroelectric Thin Films

S.B. Lang

Determination of the Thickness
Spatial Polarization Distribution in
Sputtered PZT Thin Films Using the
Laser Intensity Modulation Method

T. Sandner, G. Suchaneck, B. Köhler, and G. Gerlach

Domain Kinetics Revisited: Experiments and Modeling

V. Gopalan, A. Itagi, S. Gerstl, P. Swart, and E.E. Mitchell

ISIF'99 PAPERS

Probing Statics and Dynamics of
Domain Switching in Epitaxial PZT
Films Using X-Ray Scattering

*C. Thompson, A. Munkolm, K.
Ghosh, O. Auciello, and G. Bai*

Studies of Ba_{1-x}Sr_xTiO₃ Thin Films
Growth Processes Using *in situ*
Time-of-Flight Mass Spectroscopy
of Recoiled Ions

*A.M. Dhote, A.R. Krauss, O.
Auciello, J.Im, and R. Ramesh*

X-Ray Standing Wave Analysis of
Domain Switching in Single Crystal
Lead Zirconium Titanate (PZT)

Thin Films

*M.J. Bedzyk, O. Auciello, C.
Thompson, S.K. Streiffer, B.G.
Stephenson, J.A. Eastman, G.R.
Bai, D.A. Marasco, A.
Kazimirov, T-L. Lee, and C.B.
Eom*

In situ Studies of the Surface
Structure of Strontium-Bismuth-
Tantalate Films Using Time-of-
Flight Ion Scattering and Recoil

A. Gru

Imprint, R
Back-Swi
and Fatigu
Studied by
copy

E.L. C

Polarizatio
Micron Fe

*R. Ram
Nagar*

*Su, A.
and E*

The Ferro
Interface

A. Har

Theory of
Y. Ishi

How to Le
from the S

V.Y. S

Makar

Nikola

Studies of Hydrogen-Induced
Degradation Processes in Pb(Zr
Ti_{1-x})O₃ (PZT) Ferroelectric Film-
Based Capacitors Using Massing
Spectroscopy of Recoiled Ions,
Raman Spectroscopy Analysis and
Electrical Characterization
*A.R. Krauss, J. Im, O. Auciello,
A. Dhote, S. Aggarwal, and R.
Ramesh*

The Effects of Oxygen Deficiency
on Vacancy Related Defects in
(Pb,La)(Zr,Ti)O₃ Capacitors Studied
by Positron Annihilation Spectros-
copy
*T. Freissnegg, S. Aggarwal, R.
Ramesh, B. Nielsen, D.J. Keeble,
and E.H. Poidexter*

Spectroscopy
*J. Im, O. Auciello, A.R. Krauss,
J. Lettieri, and D.G. Schlom*

NOVEL CHARACTERIZA- TION - II

Electric Force Microscopy of
Ferroelectric Thin Films
C. Ahn

Scaling of Ferroelectric Properties
in Thin Films
*C. Ganpule, A. Staneshevsky, Q.
Su, S. Aggarwal, J. Melngailis,
E. Williams, and R. Ramesh*

SFM Characterization of SrBi₂Ta₂O₇
Thin Films for Nanoscale Memory
Applications

Piezoelect
xTix)O₃a
Films Usin
copy
*J.A. C
Kim, J
and A*

180 Doma
ments in F
*J.E. B
G.S. W*

PIEZOE MEMS A

Hydrother
and its Ap

Page 8

Spring 1999

Ferr

ISIF'99 PAPERS

Sensors
M. K. Kurosawa

Piezoelectric Thin Films for
MEMS Applications
*S. Troler-McKinstry, F. Xu, J-
P. Maria, R. Polcawich, W. Ren,
and J. F. Shepard, Jr.*

Optimization of PZT Thin Film
and Device Design for Piezoelec-
tric Micro Sensors
P. Murali

*B. Willing, P. Murali, N. Setter,
T. Reimann, and O. Oehler*

Effect of Stoichiometry on the
Ferroelectric Properties of
(Pb_{1-x}La_x)TiO₃ Thin Films
*I-N. Lin, C-H Lin, Y-H Hsu, and
H-F. Cheng*

Mn- and Sb-doped PZT Thin Films
for Uncooled Infrared Detector
Array
Y.Q. Xu, N.J. Wu, and A. Ignatiev

TESTING AN CHARACTE

Electrical Meas
Speed Switchin
Micron-Scale D
Capacitors
*A.D. DeVilb
Devilbiss*

Preparation and
PZT Thin Films
Conducting Ox
J.F. Scott, S

Epitaxial Single Crystal Hetero-
structures of Piezoelectric $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{-PbTiO}_3$ (PMN-PT) / Metal-
lic Oxide SrRuO_3 " ¹⁷
*C. B. Eom, D. LaVric, Q. Gan,
and R. A. Rao*

Microfabrication and Properties of
Thin Film PLZT Cantilevers
*H. Cherry, J. Tseng, C-H.
Cheng, and G. Um*

Dielectric Hysteresis Under
Transverse Electric Fields in Sol-
Gel Lead Zirconate Titanate (PZT)
Films Deposited on ZrO_2 Passi-
vated Silicon
*B. Xu, Yaohong, Ye, and L. E.
Cross*

PYROELECTRIC AND OPTICAL APPLICATIONS

Sputtering of PZT Thin Films for
Surface Micromachined IR-
Detector Arrays
*R. Bruchhaus, D. Pitzer, M.
Schreiter, and W. Wersin*

Pyroelectric Thin Film Arrays for
Gas Spectrometry Applications

Integrated Electro-Optic Lenses and
Scanners on Ferroelectric LiTaO_3 " ³
*V. Gopalan, K.T. Gahagan, J.M.
Robinson, Q.X. Jia, and T.E.
Mitchell*

Novel Photoferroelectric Phenom-
ena in Lead Zirconate-Titanate Thin
Films
*A. Kholkin, N. Setter, O.
Boiarkine, and A. Safari*

Poling of Ti Rich Lead Titanate
Based Pyroelectric Thin Films
P. Muralt and M. Kohli

Deposition of Lithium Niobate Thin
Films on Diamond/Silicon Sub-
strates for High Frequency Surface
Acoustic Wave Filter Applications
*S. Wang, T.A. Rabson, Q. Su, and
M.A. Robert*

Growth and Optical Waveguiding
Properties of Rf Sputtered Lithium
Niobate Thin Films on Sapphire
Substrates
*E. Dogheche, D. Remiens, and
X. Lansiaux*

Hasenkox,

Nonlinear Diele
PZT Films at S
for Two Differ
ization Fatigue
D.V. Taylor

An Optimized P
odology for Tes
ries
S. Mitra an

Study of Degrad
 $\text{Pb}(\text{Zr}_{1-x}\text{Ti}_x)\text{O}_3$
tric Capacitors
Conduction An
*I. Stolichno
Cross, M. F
Tsukada*

Explanation of
Behavior of the
Based on Time-
Current
*A.T. Bartic,
Norga, H.E
Adriaensse*

A Novel Proce
Modeling of Di
and the Circuit
DRAM Operati
*B-T. Jang,
Lee*

POSTERS: MATERIALS PROCESSING FOR DRAMS

Electrical Properties of (Ba,Sr)TiO₃ Thin Films Doped by Ion Implantation

J.D. Baniecki, Q.Y. Ma, R.B. Laibowitz, T.M. Shaw, P.R. Duncombe, D.E. Kotecki, H. Shen, and J. Lian

Dielectric Properties of Sr_{0.91}TiO_{3.01} Films Grown by MBE

J.H. Haeni, D.G. Schlom, W. Tian, X.Q. Pan, H. Chang, I. Takeuchi, and X-D. Xiang

Electrode Effects on the Low-Frequency Dielectric Properties of (Ba,Sr)(TiO₃) Thin Films Prepared by Pulsed Laser Ablation

S.J. Lee, K.Y. Kang, S.D. Jung, J-W. Kim, and S-K. Han

Reliability of High Dielectric Ba_{0.5}Sr_{0.5}TiO₃ Capacitors Using Iridium Electrode

S.Y. Cha, B-T. Jang, and H.C. Lee

Structural Properties of Ba_{0.6}Sr_{0.4}TiO₃ Thin Films on Epitaxial RuO₂ Electrodes

Q.X. Jia, C. Kwon, and P. Lu

High Dielectric (Ba_{1-x}Sr_x)(Ti_{1-x}Zr_x)O₃ Thin Film Capacitors for Semiconductor Memory Device Applications

J-S. Kim and S-G. Yoon

BST Thin Films with Conducting Perovskite Electrodes for DRAM Applications

B. Nagaraj, T.K. Song, T. Sawney, S. Aggarwal, R.

Low-Temperature Growth of (101)-Oriented Barium Titanate Thin Films on Silicon (111) Substrates by Rf Magnetron Sputtering

J-T. Lee, Q. Su, T.A. Rabson, and M.A. Robert

POSTERS: FUNCTIONALLY GRADED FERROELEC- TRICS

Graded Pb(Zr,Ti)O₃ Thin Films

M. Brazier, M. McElfresh, and S. Mansour

A Method for Depositing Compositionally Varied Multi-Layered Oxide Thin Films

M. Brazier, M. McElfresh, and S. Mansour

Electrical Characteristics of Graded PZT Pressure Sensor

T.S. Kalkur

Asymmetric C-V Characteristics of Graded PZT Thin Film Capacitors

Z. Chen, K. Arita, M. Lim, and C. Paz de Araujo

POSTERS: PIEZOELECTRIC AND MEMS APPLICATIONS

High Frequency Ultrasonics Using PZT Sol-Gel Composites

M. Lukacs, M. Sayer, and S. Foster

Piezoelectric Properties of Lead Zirconate Titanate Thin Films Characterized by the Pneumatic Loading Method (PLM)

D-G. Kim and H-G. Kim

PZT-Base Application
S-Y. C

Critical Th Oxidation Films

J-W. K and H

Compositionality of Pb(Zr,Ti)O₃
H. Ma A.I. Ki Neuma

Fabrication of Micro Piezoelectric Transducers
B. Pie Zakar Piekar DeVoe

POSTER QUENC

Correlation of Critical D Ferroelectric Filters

G. Sub Keuls, Caned Venka

Microwave SrTiO₃

A. Koz Ivanov Pruda

Microwave (Ba,Sr)TiO₃

Spring 1999

Ferr

ISIF'99 PAPERS

X. Zhang, Y. Zhu, S. Stowell, S.
Sengupta, T.V. Rivkin, C.M.
Carlson, P.A. Parilla, and D.S.
Ginley

Growth and Characterization of
 $\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$ (BST) Thin Films on
Selected Electrode/Diffusion
Barrier Heterostructures for
Application in High Frequency
Devices
P.K. Baumann, S.K. Streiffer, O.
Auciello, M.T. Lanagan, J.
Giumarra, R.A. Erck, J. Im, and
A.R. Krauss

Ferroelectric Lens Antenna with
Interdigitated Electrodes
J.B.L. Rao, D.P. Patel, L.C.
Sengupta, L. Chiu, X. Zhang, Y.
Zhu, S. Stowell, and S. Sengupta

Ferroelectric Thick and Thin Film
Varactors
L.C. Sengupta, L. Chiu, X.
Zhang, Y. Zhu, S. Stowell, S.

MgO (100) and LaAlO_3 (100)
Substrates
C.M. Carlson, J.C. Price, T.V.
Rivkin, P.A. Parilla, and D.S.
Ginley

Development of $\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$ -Based
Ferroelectric Structures on Silicon
for Room Temperature Microwave
Applications
C.L. Canedy, S. Aggarwal, A.
Henry, H. Li, L. Salamanca-
Riba, T., Venkatesan, R. Ramesh,
F.W. Van Keuls, R.R.
Romanofsky, N.D. Varaljay, and
F.A. Miranda

The Effects of Various Dopants on
Barium Strontium Titanate
F. Barnes, R. Benton, H.-D. Wu,
and S. Chumchuensuk

POSTERS: PYROELECTRIC AND OPTICAL APPLICA-

Effects of Platin
trode Orientatio
ture, Texture an
ties of PbTiO_3
by DC Magnet
Y.S. Ahn, D
Lee, H-J. W
and E. Yoo

Growth of LiNb
Crystal Sapphir
Pulsed Laser D
Y. Gim, K.T
M. Hawlen,
Robinson, T
Q.X. Jia

The Effect of G
on Pulsed Laser
 $(\text{Ba,Sr})\text{TiO}_3$
for Pyroelectric
tions
L.F. Schlos

Pyroelectric Pro
Doped Lead-Zi

<i>Sengupta, T.V. Rivkin, C.M. Carlson, P.A. Parilla, and D.S. Ginley</i>	TIONS Microstructural Characterization of Epitaxial PbTiO ₃ Thin Films Using Synchrotron X-Ray Diffraction <i>K.S. Lee and S. B. Baik</i>	Thin Films Prep Processing <i>C.W. Tipton Robertson, Sawhney, R Velasquez,</i>
Circularly Polarized Microstrip Patch Fed by X-Band Phase Shifter Made from Ferroelectric Materials <i>S. Stowell, Y. Zhu, L. Sengupta, S. Sengupta, X. Zhang, and L. Chiu</i>	Epitaxial Lead-Based Ferroelectric Thin Films for Integrated Optics Applications <i>E. Dogheche, A. Boudrioua, D. Remiens, and J.C. Loulergue</i>	Infrared Absorp Thin Film Struc Novel Conduct <i>R.C. Hoffman Robertson, Tidrow, W. Aggarwal, Udayakuma Hanson</i>
Low Loss Tunable Dielectric Constant Materials on Intragrain Concentration Gradient (Ba,Sr)TiO ₃ Ceramics <i>I. Lubomirsky, O.M. Stafsudd, and F. DeFlaviis</i>	Peculiarities of Pyroelectric Proper- ties of Low-Coercive Ferroelectric PZT-Based Materials <i>Y.N. Zakharov, G.M. Akbaeva, V.Z. Borodin, and A.G. Lutokhin</i>	Deposition and Scandium Tant High Performan Arrays <i>M.A. Todd,</i>
Structural and Dielectric Effects of Annealing on High Quality Laser- Ablated Ba _x Sr _{1-x} TiO ₃ Thin Films on	Fabrication of (Pb,Lu)TiO ₃ Thin Films by Pulsed Laser Deposition <i>J-H. Yang and S-G. Yoon</i>	

Ferroelectricity Newsletter

ISIF'99 PAPERS

<i>Jones, D.J. Wallis, M.J. Slater, M.A.C. Harper, D.J. Williams, M.J. Crosbie, P.J. Wright, and R. Watton</i>	An Optimized Process for SrBi ₂ Ta ₂ O ₇ Thin Films Using a Novel Chemical Solution Deposi- tion Technique <i>S-H. Kim, D-J. Kim, J-P. Maria, A.I. Kingon, J. Im, and S.K. Streiffer</i>	The Reliab Films for F Applicatio <i>T. Li, F Hsu</i>
Dielectric and Electromechanical Properties of Pyrochlore-Free PB(Mg _{1/3} Nb _{2/3})O ₃ Thin Films <i>Z. Kighelman, D. Damjanovic, a. Seifert, L. Sagalowicz, and N. Setter</i>	Microstructure Evolution and Leakage Phenomena of CSD PLZT Thin Films <i>M. Fujiki, J.S. Cross, J. Tsukada,</i>	Electrical and/or Bi- Prepared b <i>C.I. C Kim</i>

The Effect of Crystalline Structure
on the Pyroelectric Properties of
Lead Titanate Based Devices

*R.P. Godrey, C.L. Canedy, C.
Ganpule, T. Venkatesan, R.
Ramesh -C.W. Tipton, and R.C.
Hoffman*

POSTERS: MATERIALS PROCESSING - CHEMICAL SOLUTION DEPOSITION

Epitaxial Growth of SBT Thin
Films by Chemical Solution Deposi-
tion

*J.H. Kim, F.F. Lange, and C. I.
Cheon*

Temperature and Frequency Stable
Sr₂(Ta_{1-x}Nbx)2O₇ Dielectric Films
by Sol-Gel Processing

*Y.W. Shin, A.C. Kirby, and S.K.
Dey*

Crystallization Behavior of Alkoxy-
Derived SrBi₂Ta₂O₉ Thin Films on
Pt-Passivated Si

K. Kato

Synthesis of Controlled Carbon
Content MOD Precursor Solutions
for Bismuth Layered Structures

*T. K. Dougherty, O.G. Ramer,
and J. Drab*

*K. Matsuura, H. Ashida, and S.
Otan*

The Solvent Effect on the PZT
Precursors

*W-W. Zhuang, R. Barrowcliff,
and G. Stecker*

POSTERS: MATERIALS AND PROCESSES FOR NVFERAMS

Properties of Zirconium Doped Sr-
Bi-Ta-O Thin Films

*R. Barz, S.K. Dey, and D.
Neumayer*

Intrinsic Stress Dependence of Pt
Hillock Formation and its Related
Electrical Properties of SBT Capaci-
tor

*S.Y. Kweon, S.J. Yeom, H.J. Sun,
N.K. Kim, Y.S. Yu, and S.K. Lee*

XRD Data and Low-Temperature
Phase of Sr-Bi-Ta-O Films

*J.S. Lee, H.J. Kwon, H.H. Kim,
and Y.W. Jeong*

Investigation of Growth Evolution
in c-Axis SrBi₂Nb₂O₉ Epitaxial
Thin Films

*J. Lettieri, Y. Jia, D.G. Schlom,
G.W. Brown, M.E. Hawley, R.
Uecker, and P. Reiche*

Improvem
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Influences
SrBi₂Ta
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Sol-Gel PZ
V.Y. S
Subbo
Bolten
Waser

Characterization of **Plasma** Etch Processes for Ferroelectric Materials in a High Density **Plasma** Reactor Modified to Facilitate Volume Device Manufacturing
P. Werbaneth, M. Huffman, J. Meyer, A. Quick, and S. Ross

POSTERS: TESTING AND CHARACTERIZATION

Issues for Scaling of Ferroelectric Thin Films for Low Voltage Operation
S. Bilodeau, S. Johnson, M. Russell, D. Vestyck, P. VanBuskirk, J. Roeder, T. Baum, B. Hendrix, and D. Desrochers

Investigation into the Reliability of Ferroelectric Memories
D. Dalton, and T. Davenport

Local Charge Compensation-Assisted Cation Place Exchange and Ferroelectric Fatigue Resistance of SBT
A.C. Palanduz, and D. M. Smyth

Accurate Electrical Characterization of (Ba,Sr)TiO₃ Films Utilizing Transmission Matrices
A.C. Kirby and S.K. Dey

Polarization Relaxation in PZT Thin Film Capacitors
I. Jenkins, V. Nagarajan, S. Aggarwal, B. Nagaraj, T.K. Song, and R. Ramesh

R. Waser

The Switching Characteristics of SrBi₂Ta₂O₇ Thin Film Prepared by MOD Method
X.B. Chen, F. Yan, Z.G. Zhang, J.S. Zhu, and Y.N. Wang

Studies of Retention Behavior of SrBi₂Ta₂O₇ Thin Films
Z. Zhang, J. Zhu, J. Liu, F. Yan, X. Chen, X. Lu, H. Shen, and Y. Wang

Fatigue Induced Evolution of the Domain Structure in Epitaxial Thin Films
V.Y. Shur, S.D. Makarov, N.Y. Ponomarev, E.V. Nikolaeva, E.I. Shishkin, L.A. Suslov, N.N. Salaschenko, and E.V. Kluev

POSTERS: FIELD EFFECT TRANSISTORS

Interfacial Control of SrBi₂Ta₂O₇ Based Field Effect Transistor with YSZ, CeO₂ Buffer Layer
J-K. Lee, S-M. Jang, J-H. Kim, and H-J. Jung

Effect of Crystallinity on Ferroelectric Thin Film Transistor
H. Fujisawa, S. Aggarwal, and R. Ramesh

The Integration of SrBi₂Ta₂O₇ / Insulators/Si Structure for MFIS in NDRO-Type FRAM
W-J. Lee, C-R. Cho, C.H. Shin,

SBT-Based Ferroelectric Nonvolatile Memory (NDRO) Memory
M. Lim and

TEM Observation of Ferroelectric Films Grown on Y₂O₃ Buffer Layer
M.M. Sarin, Shoriki, B-E and H. Ishi

Integrating Part of a Metal-Ferroelectric Field Effect Transistor
T. C. MacL

POSTERS: MEMORY PROCESSING

Phase and Microstructure Evolution During the Bismuth Films Substrates
C-H. Lu and

Preparation and Properties of Strontium Bismuth Tantalum
C-H. Lu and

Influence of the Oxide on the Properties of La Bismuth Tantalum
Y-C. Chen and

POSTERS: MEMORY PROCESSING

Reversible and Irreversible Domain
Wall - Contributions to the Polar-
ization in CSD Prepared

Ba_{1-x}Pb_xTiO₃ Thin Films
*M. Hoffmann, D. Bolten, U.
Hasenkox, O. Lohse, and*

B-W. Kim, B-G. Yu, and K-I. Cho

Pt/PZT/TiO₂ Gate Stack Etching by
Using TiO₂ Hard Mask for Metal-
Ferroelectric-Insulator-Semiconduc-
tor (MFIS) FETs

*C.W. Chung, T-Y. Kim, C.J. Kim,
and I. Chung*

Deposition of P
Films by Direct
MOCVD

*J. Goswam
Wang, and*

Epitaxial Grow
RuO₂ Thin Film

12

Page 13

Ferroelectricity Newsletter

ISIF'99 PAPERS

*P. Lu, S. He, F.X. Li, and Q.X.
Jia*

Effect of Rf Power on the Micro-
structures and Electrical Properties
of SBT Thin Films by **Plasma-**
Enhanced Metalorganic Chemical
Vapor Deposition
W-C. Shin and S-G. Yoon

Fabrication of Ferroelectric YMnO₃
Thin Films for Nonvolatile Memory
Devices by MOCVD and
PEMOCVD

*G-J. Choi, W-C. Shin, and S-G.
Yoon*

Developm
Long Life
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Systems

*F.P. G
G.S. T
Zhang
Desu,*

PIEZOELECTRICITY AND PYROELECTRICITY DATABASE (PPDB)

The database used in Professor Sidney B. Lang's "
which appears semiannually in

Ferroelectrics

Guide to the Literature of Piezoelectricity and

is now accessible on the Gordon and Breach Internet Web

The current version of the Piezoelectricity and Pyroelectricity Database (PPDB) contains references to most of the publications on piezoelectricity and pyroelectricity during the period 1990-1996. The database will be updated with an additional 500-1000 new references about twice a year. In order to make the database as comprehensive as possible, references are included even if piezoelectricity and/or pyroelectricity formed a very minor part of the contents of the publication. The current database contains 10722 references.

References are given for articles in journals, chapters in proceedings or books, books, patents, theses and reports. Full bibliographic information is given so that the reader can locate the publication. Additional information such as conference presentation data, language (if other than English) and patent assignees is given where available.

The URL for accessing PPDB is

http://www.gbhap-us.com/c3/lit_guide/

Information in the PPDB can be accessed in two ways: (1) Direct search of the database on the Internet or (2) Downloading of the entire database and a public-domain search engine to the user's computer. Full instructions are supplied.

Any problems with the PPDB or suggestions should be sent to:

Prof. Sidney B. Lang

Department of Chemical Engineering, Ben-Gurion University of the Negev, 84105 Beer Sheva, Israel

fax: +972-7-647-2916; email: lang@bgumail.bgu.ac.il

Volumes 217, 218, and 219, Numbers 1 - 4 (1998)
of *Ferroelectrics* contain the proceedings of

The Sixth Japanese - CIS/Baltic Symposium on Ferroelectricity

held in Noda, Japan

22 - 25 March 1998

Page 14

Spring 1999

Ferr

VERSAILLES PROJECT

VERSAILLES PROJECT ON ADVANCED MATERIALS AND STANDARDS

Mark Gee and Markys G. Cain of the National Physical Laboratory in Teddington, UK, are initiating a project to evaluate measurement methods for determining the performance related properties of electroceramics. They are planning to enlist the cooperation of measurement laboratories interested in this project.

Electroceramics, such as piezoelectric and electrostrictive materials, have the capability of converting electrical energy into mechanical energy (or vice versa). The technological importance of these materials is increasing, with widespread applications in actuator and sensor applications.

Although there has been some standardization activity

projects cannot be fully predicted in advance of the survey. However, it is expected that work will be carried out at least on the development of recommended procedures for the following four projects:

1. Measurement of piezoelectric coefficients of differing geometries and configurations including the assessment of direct and converse coefficients

through bodies such as the IEEE, and more recently through CENELEC in the development of new standards, many of the most important properties that are required for these materials when used as sensors and actuators remain without internationally recognized test methods.

Measurements where work is required include:

- * direct and converse piezoelectric coefficient measurement
- * high stress dielectric property measurement
- * the measurement of strain at high stresses, and
- * the measurement of degradation of materials performance under repeated electrical and mechanical loading.

Industries that would benefit from these activities are the manufacturers of materials, sensors, actuators, and any industries that incorporate devices based on these materials.

Although further practical measurement-based projects would be expected to follow, the subject of these

2. Measurement of piezoelectric strain cal/mechanical stress
3. Measurement of piezoelectric and di ties at high stress
4. Measurement of electrical and mech piezoelectric ceramics materials.

Appropriate links would be developed with of the CENELEC committee (Alan Thomas) route forward to the development of standard prestandardization work performed in the Te Area is straightforward.

It is expected that the development of standa would proceed from Autumn 1999 with an e lifetime of 2-3 years.

Please direct any inquiries to:
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United Kingdom
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email: markys.cain@npl.co.uk

Volume 220, Numbers 3-4 (1999) of ***Ferroelectrics***
is a special issue on
Ferroelectric and Related Models in Biological Systems

A collection of papers from the
Second Workshop on Nonlinear Models of Biomembrane Molecular Structures
held in Pushchino, Russia, 26 June - 1 July 1995
&
The Workshop on Condensed-state Models of Voltage-dependent Ion Channels
Kansas City, Missouri, USA, 25 February 1998

14



Page 15

Ferroelectricity Newsletter

NEW RELEASES FROM THE MATERIALS RESEARCH SOCIETY

MRS Expands Series on Thin Films-Stresses and Mechanical Properties

The newest volume is a continuing series from the Materials Research Society, *Thin Films-Stresses and Mechanical Properties VII*, documents symposium reports from the 1997 MRS Fall Meeting in Boston, Massachusetts, and contains 95 papers, 646 pages.

Mechanical behavior in thin films continues to be a growing field of interest in the materials research community. This behavior can critically influence the design, performance, and reliability of thin-film structures used in every area of thin-film technology. Examples of affected areas include semiconductor and magnetic recording technology, as well as protective and hard-coating technology. As a result, it has become important to study and attempt to understand fundamental issues involved in film-substrate adhesion, the development of intrinsic stresses, and the mechanisms of plastic deformation, strain relaxation, and fracture in thin films.

This volume, the seventh in a popular series from the MRS, brings together an international group of researchers and students from industry, academia, and national laboratories to address the issues at hand. A great deal of work is directed toward improving existing, as well as developing new, mechanical property characterization techniques, such as more sensitive ultrasonic methods for elastic behavior determination and low-load indentation methods to investigate yield, creep, and fracture behavior. Experimental, theoretical, and modeling work is presented. Topics include: novel testing methods; low-load indentation; metallization and reliability; structural and mechanical stability; stresses and mechanical behavior; surface and tribological properties; adhesion; deformation mechanisms; stresses in thin films-generation mechanisms and measurement techniques; modeling and simulation; multilayered and superlattice thin films; and structure/property/processing relationships.

Edited by Robert C. Cammarata (Naval Research Laboratory), Michael A. Nastasi (Los Alamos National Laboratory), Esteban P. Busso (Imperial College, University of

Symposium Proceedings Series. I hardcover or microfiche for \$62.00 (\$71.00 (US list), and \$82.00 (No

MRS Introduces New Additions Low-Dielectric Constant Materials

The latest edition in the continuing Materials Research Society, *Materials IV*, documents symposium reports from the 1998 MRS Spring Meeting in San Antonio, Texas, and contains 49 papers, 386 pages.

While this volume continues the science related to the development of (low-k) constant materials, it part four major areas: polymeric and dielectrics; metrology and characterization; integration and low-k interconnects. These are in the development of low-k dielectrics, where materials and process play a significant role in controlling the structural reliability of the interconnect. The volume is edited by invited and contributed papers from universities and industry, illustrating the interdisciplinary nature of the field.

Edited by Chien Chiang (Intel Corporation), Ho (University of Texas-Austin), (Rensselaer-Polytechnic Institute), Wetzels (Motorola Inc.), *Low Dielectric Constant Materials IV* (ISBN: 1-55899-1-55899-1) in the MRS Symposium Proceedings Series, available in hardcover or microfiche (\$72.00 (US list), and \$82.00 (No

For further information, or to place an order, contact:

Materials Research Society
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506 Keystone Drive
Warrendale, PA 15086

Spring 1999

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PUBLICATIONS

1999 MRS Publications Catalog Supplement Now Available

The **1999 Materials Research Society (MRS) Publications Catalog Supplement**, containing 72 new books—all exploring interdisciplinary research on advanced materials—is now available. The volumes span many subject areas, including biomedical materials, catalysts, ceramics and composites, computational methods, electronic materials and processing, education, glasses and insulators, materials characterization, metals and alloys, novel processing/applications, nuclear waste management, polymers, sensors, and more.

Also featured in this Supplement is the new **Proceedings of the 12th International Zeolite Conference**. With four volumes and more than 3360 pages, this proceedings is one of the largest collections on zeolite science ever assembled.

To receive a free copy of the 24-page catalog, contact the Material Research Society, Customer Services Department. (For address, phone, and fax, see previous page.)

Proceed-

Ferroelectric Memories Featured in

Orlando Auciello (Argonne National Laboratory, Argonne, Illinois, USA), **James F. S. M. Azevedo** (New South Wales, Sydney, Australia), and **Ramesh** (University of Maryland, College Park, USA) published an article called **"Ferroelectric Memories"** in the July issue of **Physics Today**.

After discussing basic ferroelectric physics, the article explains how NVFRAMs work and gives an overview of early developments in the field of ferroelectric memories. Capacitor degradation and extending the polarization retention time were obstacles which could not be overcome by using thin-film technology. But that was not all the problems. Today there are still basic problems related to ferroelectric memories we do not completely understand. The authors deal with these challenges, describe the current state of thin-film technology and industrial ferroelectric memories, and conclude with an evaluation of the role ferroelectric memories will play in the future. The article features two boxes: "DRAMs based on ferroelectric materials with high permittivity" and "Other applications of ferroelectric materials."

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including all back issues is available on Internet

<http://www.sp.nps.navy.mil/projects/ferro/ferro.html>

in Adobe Acrobat PDF file format

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or rpanholzer@nps.navy.mil

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16

Page 17

Ferroelectricity Newsletter

UPCOMING MEETINGS

The 15th Russian Conference on Physics of Ferroelectrics

14 - 18 September 1999

Azov, near Rostov-on-Don, Russia

Sponsored by the Ministry of General and Professional Education of Russia, the Scientific Committee of Physics of Ferroelectrics of the Russian Academy of Science, Rostov State University, Rostov State Pedagogical University, the Scientific and Research Institute of Physics at Rostov State University, and the Moscow Institute of Radio Engineering, Electronics and Automatics - Technical University, the 15th Russian Conference on Physics of Ferroelectrics, with the participation of foreign scientists, will be held in Azov from 14 - 18 September 1999.

Topics

- * Physical properties of ferroelectrics
- * Phase transitions and critical phenomena
- * Structure and dynamics of crystal lattice
- * Relaxor ferroelectrics
- * Surface phenomena, nanocrystals, incommensurate phases, etc.
- * Domain structure and processes of switching

- * Physical properties and processes in ceramics and compound materials

Forms of Presentation

- * Plenary presentation (40 minutes)
- * Original presentation (15 minutes)
- * Poster presentation
- * Official languages are Russian and English

Organizing Committee:

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 V. P. Sakhnenko (Rostov-on-Don) - vice-chairman
 I. N. Chugueva (Moscow) - scientific secretary
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 V. V. Lemanov (St. Petersburg)
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 V. Y. Shur (Ekaterinburg)

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UPCOMING MEETINGS

Piezotechnique 99

14 - 18 September 1999

Azov, near Rostov-on-Don, Russia

This international conference covering scientific and practical aspects of fundamental problems of piezoelectricity and its applications is sponsored by the Ministry of General and Professional Education of Russia, the Russian Space Agency, Rostov State University, the Scientific & Technological Bureau Piezopribor at Rostov State University, as well as the Scientific and Research Institute of Physics at Rostov State University.

Topics

- * Theoretical modeling and design of piezoelectric transducers and devices
- * Application of materials for piezotechnique devices
- * Theoretical and experimental investigations on physics of piezoelectric transducers, on polarization processes, and technological aspects of piezomaterials processing
- * Piezoelectric materials science
- * Special instruments for investigation and testing of piezomaterials, sensors and piezoelectric transducers
- * Detecting and transforming devices, nondestructive testing devices, filters, drives, piezomotors, piezotransformers, ultrasound systems, medical equipment and household appliances
- * New directions of piezotechnique (smart materials, hybrid structures, nontraditional piezoelectric systems, nanotechnology, etc.)
- * Exhibition of piezoelectric products (materials, technologies, active elements, devices), presentation and sale of scientific and technical materials (monographs, proceedings, advertisement prospects etc.)

Exhibitions and Company Participation

Domestic and foreign piezoelectric companies are welcome to participate. Companies could present a talk as well as exhibit samples of their products.

Proceedings

The presentations will be published before the beginning of the conference as

Conference Proceed

Organizing Committee

A. E. Panich (Rostov-on-Don) - chairman
V. P. Sakhnenko (Rostov-on-Don) - chairman
A. V. Gorish (Moscow) - vice-chairman
V. K. Dolya (Rostov-on-Don) - vice-chairman
V. Y. Topolov (Rostov-on-Don) - scientific secretary

The 15th Russian Conference on Physics of Ferroelectrics

is held simultaneously with

Piezo

pants of Piezotechnique 99 can attend the 15th Russian Conference on Physics and Ferroelectrics without additional fee.

Contact

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Ferroelectricity Newsletter

UPCOMING MEETINGS

Materials Research Society 1999 Fall Meeting

29 November - 3 December 1999

Boston, Massachusetts, USA

The Fall 1999 Materials Research Society Meeting will highlight recent and significant advances in the understanding and synthesis of materials. More than 40 technical symposia will cover a wide range of topics in materials science, including self-assembled and nanostructured materials, surfaces and interfaces, thin-film materials and processes, materials including biological applications, semiconductor devices, ceramics, structural materials, and materials modeling.

New symposia will be offered in many exciting areas, such as biomineralization, the materials science of food, complex fluids, superplasticity, molecular electronics, and smart materials. Popular ongoing series of symposia will continue in nitride semiconductors, ferroelectric thin films, nanophase and nanocomposite materials, high-temperature superconductors, the materials science of MEMS devices, interfacial engineering and epitaxy, and nuclear waste management. Symposia on computer modeling and calculations in materials science will provide a forum for interaction between theorists and experimentalists. Strong interaction among the symposia will highlight the interdisciplinary nature of materials science.

Tutorial sessions in selected areas will provide introductions to new fields. There will be an exhibition of products and services of interest to the materials community, and the popular Symposium X series will feature topics on the forefront of materials science.

Sample of Symposia

- * T: Structure and electronic properties of ultrathin dielectric films on silicon and related structures
- * V: Thin Films-Stresses and mechanical properties VIII
- * Y: Ferroelectric thin films VIII
- * Z: Thin films for optical waveguide devices

Abstracts

For all abstracts submitted by email, fax, or mail, the deadline is **7 June 1999**. Because the deadline to submit an abstract is via the MRS Website-the choice of more than 90 percent of submitting authors-the deadline for abstracts submitted **via the Website will be extended until 21 June 1999**.

For specific technical information, contact any of the 1999 Fall Meeting Chairs

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Website

www.mrs.org

Page 20

Spring 1999

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CALENDAR OF EVENTS 1999

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|------------------|---|--|----------------------------------|
| Jun 7-10 | * | Transducers '99: The 10th International Conference on Solid-State Sensors and Actuators, Sendai,
Japan (see <i>Ferroelectricity Newsletter</i> , Vol. 6, No. 3, p.17) | |
| Jun 20-25 | * | Gordon Research Conference on Thin Films and Crystal Growth Mechanisms, Plymouth State College,
Plymouth, New Hampshire, USA
Gordon Research Conferences, University of Rhode Island, PO Box 984, West Kingston, RI
02894-0984; phone: +401-783-4011; email: grc@greemail.grc.uri.edu
Website: http://www.grc.uri.edu | |
| Jun 24-26 | * | 3rd Korea-Japan Conference on Ferroelectrics, Kyungju, Korea (see
Vol. 6, Nr. 4, p. 35) | <i>Ferroelectricity</i> |
| Jul 12-16 | * | 9th European Meeting on Ferroelectricity (EMF-9), Prague, Czech Republic (see
<i>Newsletter</i> . Vol. 6, No. 3, p. 18) | |
| Jul 31-
Aug 1 | * | Short Course on Crystal Growth, Tucson, Arizona, USA (see
No. 3, p. 19) | <i>Ferroelectricity Newslett</i> |
| Aug 1-6 | * | 11th American Conference on Crystal Growth and Epitaxy, Tucson, Arizona, USA (see
<i>Newsletter</i> , Vol. 6, No. 3, p. 19) | |
| Aug 4-13 | * | 18th International Union of Crystallography and General Assembly, Glasgow, Scotland | |

Aug 29- Sep 3	*	7th International Conference on Ferroelectric Liquid Crystals (FLC 99), Darmstadt, Germany (see <i>Ferroelectricity Newsletter</i> , Vol. 7, No. 1, p. 23)
Sep 14-18	*	15th Russian Conference on Physics of Ferroelectrics, Rostov-on-Don, Russia (see p. 17)
Sep 14-18	*	Piezotechnique 99, Rostov-on-Don, Russia (see p. 18)
Sep 30- Oct 2	*	European Conference on Macromolecular Physics (EPS'99), Potsdam, Germany (see <i>Newsletter</i> , Vol. 7, No. 1, p. 23)
Nov. 29- Dec. 3	*	MRS 1999 Fall Meeting, Boston, Massachusetts, USA (see p. 19)